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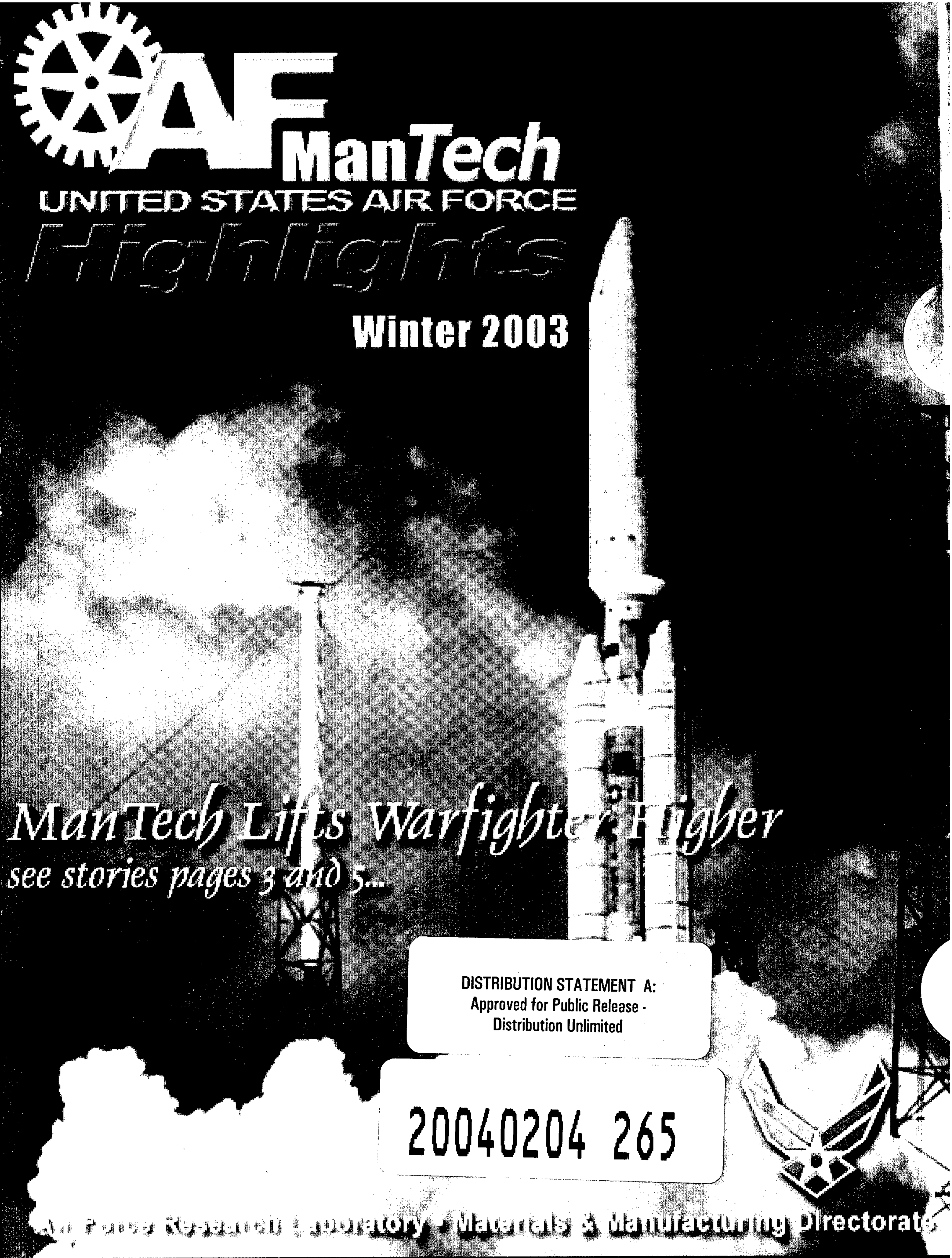
UNITED STATES AIR FORCE

Highlights

Winter 2003



ManTech Lifts Warfighter Higher

see stories pages 3 and 5...

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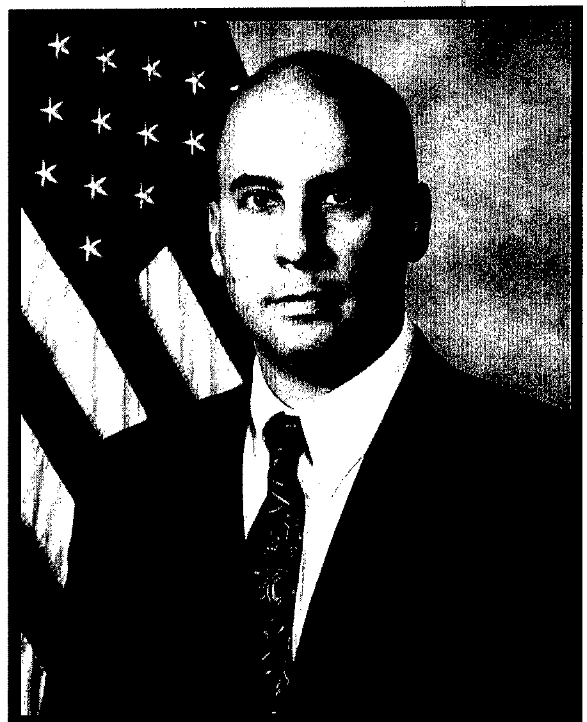
Air Force Research Laboratory • Materials & Manufacturing Directorate

ManTech's Luis Concha claims Hispanic Heritage award at Wright-Patterson



The Manufacturing Technology (ManTech) Division's own Luis Concha was one of three Air Force Research Laboratory people honored during National Hispanic Heritage Month at Wright-Patterson AFB. Concha is the deputy chief of the Electronics Branch for ManTech. The awards were part of the base's annual National Hispanic Heritage celebration.

Concha, deputy chief of ManTech's Electronics Branch, received the On-The-Job-Achievement award.

In the award nomination package, Concha was cited, among other things, as a "true leader" who "selflessly puts his knowledge, sense of purpose, experience and optimism to work every day for the betterment of the ManTech organization, and the entire Air Force." Concha was also credited with distinguishing himself as part of the newly formed Department of Defense Space Industrial Base Assessment Tiger Team. "Through his insight and innovative additions to the team's planning process, Concha ensured a more detailed and thorough analysis for a key presentation to the Under Secretary of the Air Force for Space."

Concha has been with ManTech since February of 2002.

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ManTech Highlights is an unofficial publication (cleared for public release) for the promotion of information relevant to, and about, the people and programs of the Manufacturing Technology Division of the Air Force Research Laboratory (AFRL) Materials and Manufacturing Directorate at Wright-Patterson AFB, Ohio.
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ManTech's Affordable Millimeter Wave Units Program Driving Down Costs, Weight, Size In Vital Defense Satellite Program

By Dilip Punatar
AFRL Materials and Manufacturing Directorate

Wright-Patterson AFB, Ohio – Never has the importance of defense satellites been greater than now. More are always needed, but technology and cost hurdles have served as roadblocks. That is until recently.
The Affordable Millimeter Wave Units (AMU) Program, which has achieved a rapid and highly repeatable automated assembly of module and board level AMUs, with minimal labor, and no hand tuning is revolutionizing the defense satellite industry.

Managed by the Manufacturing Technology (ManTech) Division, of the Air Force Research Laboratory's Materials and Manufacturing Directorate, under a cost-sharing contract with Northrop Grumman, AMU is a successful program that applies new forms of automated packaging to Radio Frequency (RF) modules and millimeter wave units that's driving down cost, while also decreasing the size and weight of each unit.

Microwave and millimeter wave units for defense satellites have been extremely expensive in the past – sometimes totaling more than 20 percent of the cost of a satellite. Typical applications use these units in high quantities and they are quite expensive individually – as much as $50,000 per pound. Defense satellite systems scheduled over the next few years will include more microwave hardware than ever before. Phased arrays will use thousands of microwave modules per satellite, and some satellite constellations will consist of as many as 20-30 satellites.
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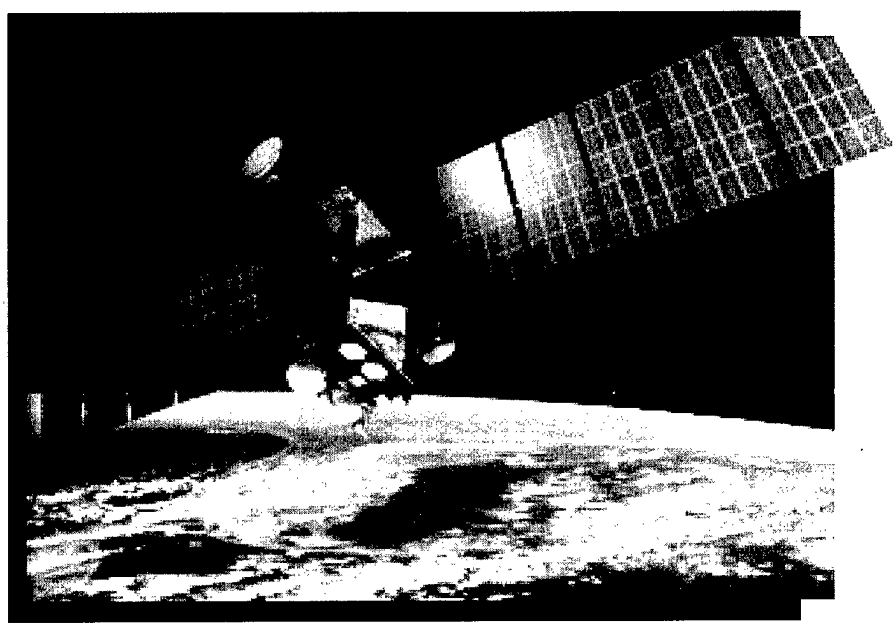


The Advanced Extremely High Frequency satellite is a beneficiary of the cost saving Affordable Millimeter Wave Unit program. (Courtesy Photo)

(continued from page 3)
Without less expensive microwave hardware, some of these key Air Force mission systems would be unaffordable. AMU's objectives were to sharply reduce the assembly and test cost of satellite microwave units by as much as 60 percent, and effect at least a 10 percent reduction in the size and weight of each unit. Early indications are that this technology will meet and surpass those objectives.

Under the new automated process, AMU's modules and units require no hand tuning due to the precise assembly procedures and an optimum radio frequency (RF) design. The new AMUs also include more printed components that further reduce the part count and cost.

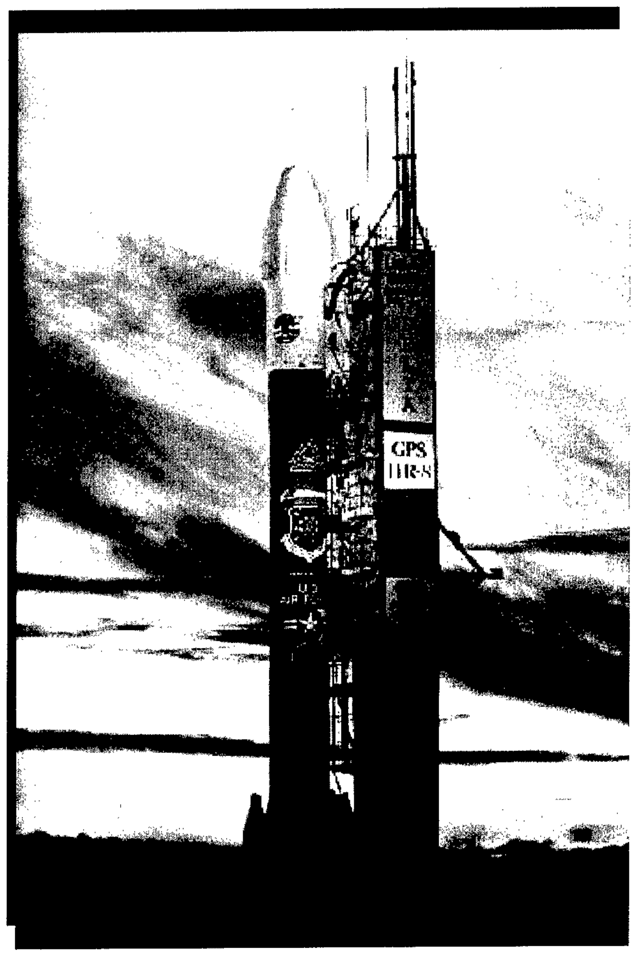
Key technologies for this program are the RF multiplayer boards that replace the previously required, and more expensive, cables, wires, coaxial connectors and simple passive components; integrated ring-frame module housings that are formed of a microwave substrate with printed traces and components, a ring, and a flat cover. Also, RF ball grid array modules are used that can be surface mounted to an RF multiplayer board in a single re-flow step, eliminating coaxial connectors and cables.

AMU has successfully demonstrated hardware designed specifically for three major defense satellite system programs. Near term space systems, such as the Transformational Satellite,' and the Space-Based Infrared System Low and Advanced Extremely High Frequency (AEHF) have had estimates placed that show that AMU's technologies will save 50-80 percent of the cost of tens of thousands of modules, which previously would cost several thousand dollars apiece. The AEHF, for example, is now well along in development and has adopted and inserted AMU's technologies in more than 100 RF board assemblies and nearly 10,000 RF modules.

The AMU Program has shown a 90 percent reduction in hardware, 65 percent reduction in parts cost, a 50 percent reduction in board size and weight and a module yield greater than 95 percent in 19 GHz boards with 37 modules and 64 connectors.

The production improvements provided through the AMU program will produce significant cost avoidances for critical Air Force satellite programs and may make the difference in whether or when specific systems and military capabilities become available to the warfighter.

For more information contact the Technology Information Center by calling (937) 255-4689, and refer to TIC item number 02-253.



A Delta II rocket, like this one, will be used to launch the new major defense satellite systems benefiting from the Affordable Milimeter Wave Unit program. (Artists conception)

Lean Production Approaches Benefit Space Vehicle Integration and Testing

By Dilip Punatar
AFRL Materials and Manufacturing Directorate

WRIGHT-PATTERSON AFB, Ohio – A joint venture between the Manufacturing Technology (ManTech) Division, of the Air Force Research Laboratory (AFRL) Materials and Manufacturing Directorate's, and researchers at Northrop Grumman have developed a lean production approach to producing multiple unique space vehicles in a more cost efficient manner, faster.

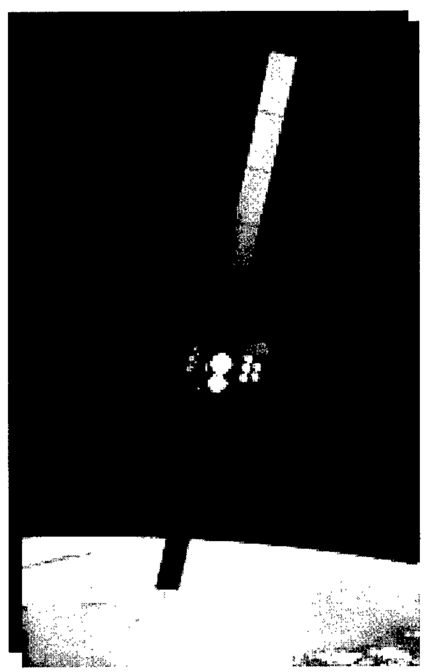
Applying this production approach to multiple space vehicle builds will save up to 50 percent in costs and 70 percent in cycle time related to mechanical build cycles. These savings are realized through simplified operations and reduced learning curves, fewer defect occurrences, span times, and new capital equipment requirements. Greater savings should be possible as a result of electronics packaging hardware developed on this program.

The program's need stemmed from the fact that space vehicle Integration and Testing (I&T) is a very costly and time consuming portion of any satellite program, with cycle times ranging from six months to several years in duration. The increasing need to quickly launch new technology has resulted in a focus upon reducing all aspects of space vehicle development and build cycles, including I&T.

ManTech and Northrop Grumman created the Flexible Space Vehicle Production Line Program, or FSVPL, that, instead of focusing on high volume and repetitive production, is geared for flexible, or variable production volumes for the high performance military and civil satellite market.

FSVPL focused its efforts in two primary areas. The first area, a design for lean production, focused upon developing designs that would be more readily producible in a volume environment modeled after the "lean production" methodology developed by Toyota and used throughout the automotive and aviation industries for decades. The second area, standardized electronics packaging, designed, developed, produced and qualified a mechanical package to house electrical components. This package is commonly referred to as the electronic "box," but includes all the mechanical housings inside the box that hold critical electrical components.

The program's technical efforts were then demonstrated in a pilot plant demonstration. Here, full-scale mockups of space vehicles were run through a simulated factory environment to validate program designs and approaches.



Less expensive, higher quality defense satellites, built faster thanks to the manufacturing technology success in the Flexible Space Vehicle Production Line program. (Artist concept courtesy Lockheed Martin)

In the area of design for lean production, the FSVPL team developed a flexible architecture approach to accommodate many missions and orbits with a variety of configuration options. This modular and scaleable architecture approach is focused upon populating panels with equipment such that these panels can be built
(continued on page 6)

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up in parallel with structural and other subsystem elements. This parallel build approach means that several teams of workers can be producing different components of the space vehicle in separate areas concurrently, instead of one team of workers building everything in serial. The architecture approach is reflected in FSVPL design guidelines developed to translate lessons learned to all new programs.

The crowning achievement of the FSVPL team was the standard electronics packaging design. This design accommodates a highly robust mechanical package allowing for easy installation, access, troubleshooting, and removal and replacement. The design is scaleable and has been fully tested to verify that it meets requirements for the most demanding space missions' thermal and acoustic environments.

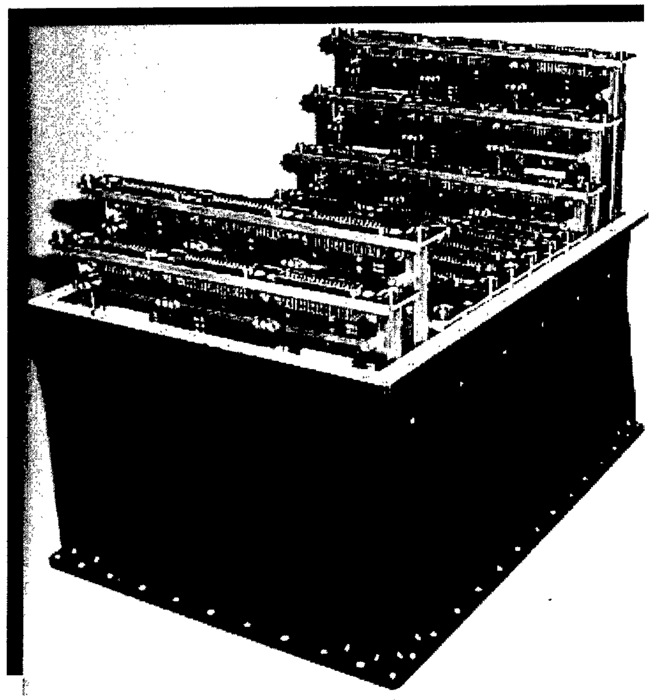
The mechanical package has now been baselined on such Air Force programs as the NPOESS (National Polar-orbiting Operational Environmental Satellite System), AEHF (Advanced Extra High Frequency system) and SBIRS Low (Space-Based Infrared System Low).

NPOESS is the nation's next-generation meteorological satellite system. AEHF provides real-time video, battlefield maps and targeting data to the warfighter, and SBIRS. Low element is the low-Earth orbiting component of the SBIRS system-of-systems for surveillance capabilities including missile warning, technical intelligence and battle space characterization.

All of these designs and approaches were demonstrated in a pilot plant activity culminating in a demonstration event last year. There, Air Force, the Space and Missile Systems Center, AFRL and NASA customers witnessed the components of FSVPL in a lean production environment, complete with single piece flow, production feeder lines and visual indicators. This two-hour demo showed two different space vehicle models being built from the box level through module integration to model mechanical integration tasks. The benefits of system modularity and parallel production could be clearly seen as components and vehicles moved through factory workstations in a manner similar to an aircraft or automotive plant.

The bottom line is that with FSVPL more satellites can be built in far less time than ever before, for much less money.

For more information on FSVPL contact the Technology Information Center at (937) 255-4689, and refer to item 02-255.



The Flexible Space Vehicle Production Line program success allows new technology defense satellites to be built and launched faster, cheaper and of higher quality. (Photo courtesy U.S. Air Force)

ManTech's Lean Value Chain Success Relieves Critical Part Shortage, Gets Warfighter Back in the Air Faster

By Gary Cunningham
AFRL Manufacturing Technology Division

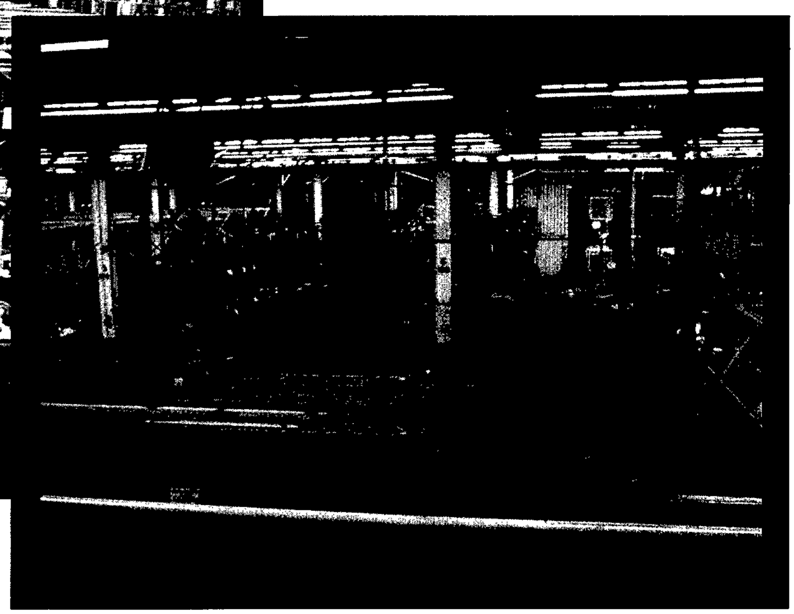
WRIGHT-PATTERSON AFB, Ohio – If a warfighter has a flying mission, but he can't get his aircraft out of the shop, then he's not doing anyone much good. That has been the plight for many Air Force and Army crews in the past whenever their aircraft was scheduled for periodic maintenance at the depot.

The depot work is vital to sustaining the aircraft fleet, but in many cases it takes too long to perform maintenance. Until recently, an aircraft engine in depot maintenance could take over 200 days to repair if it was in need of a critical part that was not in stock.

Those days are gone now, thanks in large part to engineers from the Manufacturing Technology (ManTech) Division, of the Air Force Research Laboratory's Materials and Manufacturing Directorate.

ManTech, in cooperation with KBSI, Inc., of College Station, Texas, developed and implemented a Lean Value Chain (LVC) program that dramatically decreased critical part shortages for Air Force and Army depots. A goal of LVC, to reduce critical part resolution time by 50 percent, has been exceeded. Improved mission readiness of Air Force jet engines, such as the General Electric F100 series, and the Army's T700 helicopter engines has been achieved by returning them to service from routine depot maintenance almost twice as fast as before.

A critical part is defined as any component, when not available, that stops the repair of a major weapon system subassembly, keeping (continued on page 8)



Before Lean Value Chain was implemented, photo at left, the GE Rotor Shop at the Oklahoma City Air Logistics Center suffered from excessive parts inventories and cluttered workstations. After, photo at right, a streamlined and vastly more efficient operation is saving millions of dollars and cutting the time an aircraft spends in the hangar for depot maintenance. (U.S. Air Force Photo)

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that system out of action. Parts went critical for reasons like sole-source contract negotiation delays, delayed deliveries from the Defense Logistics Agency, and increased part condemnation rates due to age. Prior management procedures for repair parts inventory had proved inefficient at the Oklahoma City Air Logistics Center (OC-ALC) and the Army's Corpus Christi Army Depot (CCAD). Critical part resolution time in the OC-ALC General Electric rotor repair shop had increased to an average of more than 140 days.

The increase in quantity of work was dramatic. At OC-ALC, engine rotor overhauls went from 84 per month to 156 per month, while the average critical part resolution time went from 143 days down to 61 days. At CCAD, engine overhauls increased from 10 per month to 40 per month, while the engine cycle time through the shop decreased from an average of 326 days to just 176 days.

LVC has resulted in improved visibility of aircraft status and forecasting capability, and better information that allows more effective management decisions to be made. Management can now immediately

ManTech's Lean Value Chain program success has meant a four-fold increase in engine overhauls for the Army's helicopter fleet going through periodic maintenance at the Corpus Christi Army Depot. (U.S. Army photo)

These issues meant the depots were unable to anticipate and identify critical parts in advance, determine the best course for timely, cost-effective critical part resolution, and monitor and accelerate the critical part resolution process.

The LVC for Critical Part Procurement project was thus funded by ManTech as a solution to these problems, and was supported by OC-ALC and CCAD. The implementation of lean principles, re-engineered processes, and advanced technologies through largely computer-based resolution strategies proved to be the solution as they provided a more efficient method of running the depot operation.

First, a value stream analysis was conducted in the OC-ALC engine and the CCAD T700 helicopter engine line. Tools and technologies for a lean critical part procurement process were then implemented. The benefits were then captured and transferred to other repair lines, e.g. the KC-135.

identify inventory shortages and has greater flexibility in scheduling subsystem overhauls. There have been significant reductions in the number of critical parts, time wasted searching for parts, and parts inventories on-hand.

Increasing the mission readiness of weapon systems needed by the warfighter is the greatest payoff from the LVC program, but it is not the only one. In addition to the rate increase in rotor and helicopter engines overhauls, there has been significant cost savings. At OC-ALC, the number of rotor repair kits on-hand went from 436 to 208, resulting in an approximate $25 million one-time savings plus $4.5 million per year in recurring savings.

For more information on the LVC, contact the Technology Information Center at (937) 255-4689. Refer to item 02-511.

ManTech's AMP Provides Air Force Depots A Faster, Safer, Less Expensive De-paint Method

By Gary Cunningham
AFRL Manufacturing Technology Division

WRIGHT-PATTERSON AFB, Ohio – A revolutionary new concept being developed for the stripping, or de-painting, of large airframes like the C-5 Galaxy is expected to save the Air Force $8 million annually. The program is called Aerial Multi-axis Platform (AMP), and was developed by the Manufacturing Technology (ManTech) Division of the Air Force Research Laboratory's Materials and Manufacturing Directorate, with the cooperation of private companies, the Department of Commerce, and in partnership with the Warner Robins Air Logistics Center.

The Air Force process for de-painting (stripping) large airframes, such as the C-5, C-141, and C-130, has always posed problems, especially in accessing every part of the aircraft by workers and their equipment. Finally, the existing equipment used for the plastic media blasting process is difficult and time consuming to accurately maneuver, causing frequent collisions with the aircraft. Additionally, environmental regulation changes over time have caused increased blasting time, leading to operator fatigue and increased risk of injury. The U.S. Air Force needed a production-hardened aerial platform for de-paint environments, and out of this need AMP was developed.
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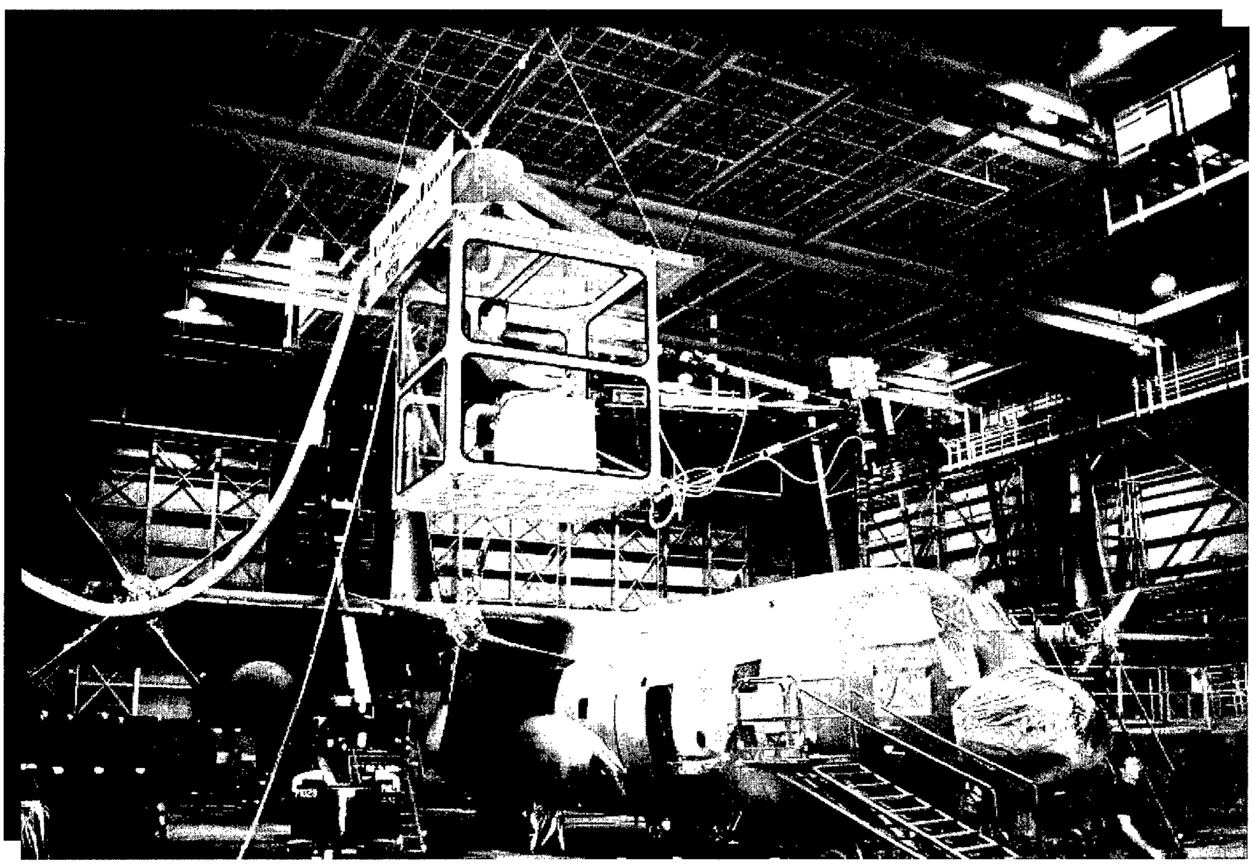

The AMP operator's booth, with blast nozzle in front, seemingly floats up, down, forward, backwards, left and right of a large aircraft, such as this C-130, to accomplish an almost flawless de-paint operation. (U.S. Air Force Photo)

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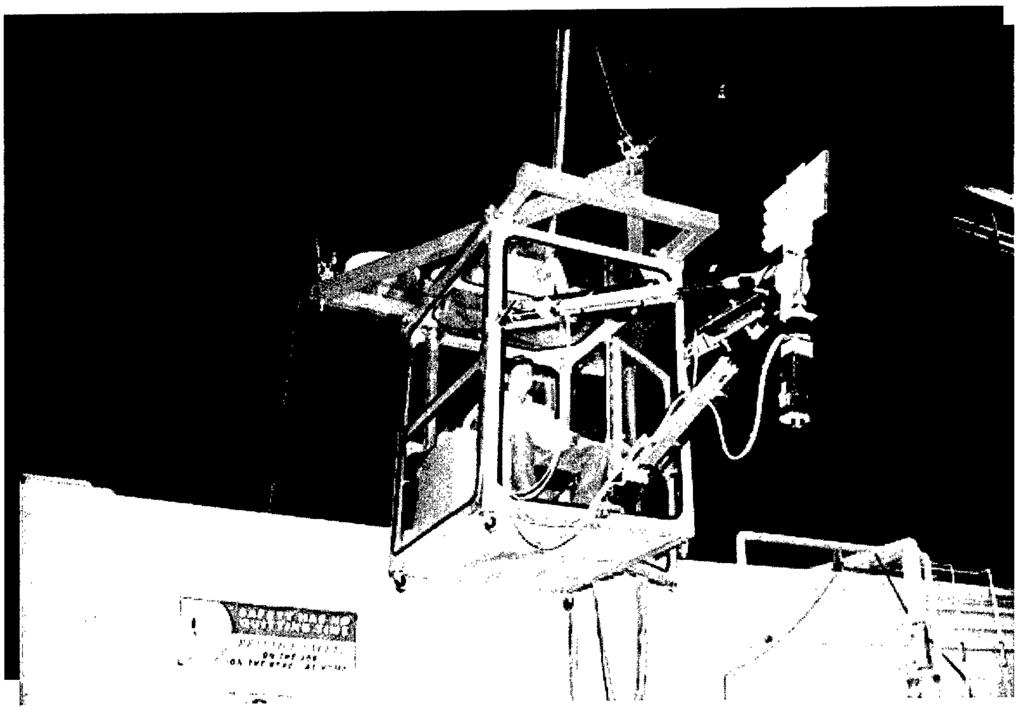
ManTech managed and co-funded the program under a cooperative agreement with U.S. Technology Corporation, a noted leader in advanced de-painting technologies. U.S. Technology integrated the program, partnering with AeroSystems, a manufacturer of overhead crane systems. They used an aerial concept developed at the National Institute of Standards and Technology (NIST), out of the Department of Commerce, called the Stewart platform. This platform provides coordinated motion of an enclosed control booth. The booth is suspended from existing hangar ceiling structures by six cables driven by six motorized winches.

A key to AMP's success is the development of the booth's coordinated motion using the Stewart platform suspended from the overhead cable system. The operator can move the sealed booth in six different directions: up, down, forward, backward, right and left. This reduces flow time by eliminating ground-based scaffolding, hoses and other clutter that inhibits efficient movement and access around the aircraft. AMP minimizes the labor required, and decreases the blasting time because the operator sits in the enclosed booth, reducing fatigue and injury. Direct costs are reduced since the system is easily adaptable to existing hangar structures.



Controlling the multiple nozzles of the manipulator with a joystick, the operator performs the abrasive blasting on large airframes faster, safer and less costly than before. (U.S. Air Force Photo)

AMP creates a 40 to 50 percent reduction in the de-paint flow time, and a 70 to 100 percent reduction in operator stress/injury. The latter results in a 20 percent reduction in overall cost associated with production paint stripping on large cargo airframes. Using the current Air Force workload of more than 200 aircraft per year, with an average cost for de-paint of $200,000 per aircraft, AMP has the potential to save more than $8 million per year.

The prototype unit was constructed and installed in a production facility at Robins AFB, Ga. The unit has been undergoing a series of modifications and operational tests to evaluate its performance under severe production environments. AMP will significantly improve the entire working environment of the de-paint program to include required preparation, de-paint and de-prep tasks from the Stewart Platform. Protected from the hazardous environment by the enclosed booth, the operator controls the multiple (ganged) nozzles of the manipulator with a joystick, and performs the abrasive blasting on large airframes faster, safer and less costly than before.

For more information on the AMP, contact the Technology Information Center at (937) 255-4689. Refer to item 03-245.

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